

SPRAY-MARKING JUVENILE SHRIMP WITH GRANULAR FLUORESCENT PIGMENT

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ABSTRACT

Spray-marking with fluorescent pigment was tested experimentally in the laboratory as a marking method for juvenile (40 to 80 mm total length) penaeid shrimp. Granular fluorescent pigment marked juvenile shrimp satisfactorily when sprayed at pressures above 150 psi at a distance of 12 inches. Mark retention was best in 80-mm juvenile shrimp spray-marked at a pressure of 240 psi. Mortality directly attributable to spray-marking was negligible.

INTRODUCTION

Studies on the dynamics and distribution of shrimp populations typically require the use of marked shrimp. The usual methods of marking shrimp such as tagging with internal and external tags and staining by injection of dyes require handling each shrimp individually (Neal, 1969), which limits the numbers of shrimp that can be marked successfully. The small size of juvenile penaeid shrimp (25 to 110 mm total length, i.e., tip of telson to tip of rostrum) and the necessity of handling each shrimp individually during marking limits the usefulness of these techniques for marking large numbers of juvenile shrimp.

Jackson (1959) originally introduced the fluorescent pigment spray-mark as a rapid, inexpensive method of mass-marking large numbers of fish with a minimum amount of handling and injury to the fish. More recent work using this technique has added improvements and refinements of spray pressures and granular pigment sizes for use with various sizes and species of fish (Phinney, Miller and Dahlberg, 1967; Phinney and Mathews, 1969; Hennick and Tyler, 1970).

K. K. Chew (personal communication, University of Washington, Seattle, Washington) used fluorescent pigment granules to spray-mark spot shrimp (*Pandalus* sp.), but found that the dye material dissipated even before the shrimp had molted. R. Butler and A. N. Yates (personal communication, Biological Station, Nanaimo, B.C.) successfully marked spot shrimp with sprayed fluorescent pigment and reported mark retention of about a month.

Spray-marking with granular fluorescent pigment in the present study was examined as a potential marking method for juvenile penaeid shrimp.

MATERIALS AND METHODS

The techniques used in the present study were modifications of those used by Jackson (1959) and Phinney (1966). Tracer-Glo¹ No. 500-A14 orange granular fluorescent pigment (Wildlife Supply Co., Saginaw, Michigan) of 50 to 60 grit size was sprayed on juvenile white (*Penaeus setiferus*) and brown (*P. aztecus*) shrimp using an air blast gun especially designed for use with Tracer-Glo pigments. Shrimp were sprayed from a distance of 12 inches (30.5 cm) at pressures of 80, 100, 120, 150, 180, 220, and 240 pounds per square inch (psi) and returned to the water immediately after being spray-marked.

Marked and unmarked shrimp were held in identical 500-liter fiberglass tanks. Experimental and control groups were examined daily for mortalities and dead shrimp were removed. Water temperature was monitored but not controlled. At 4-day intervals the marked shrimp were examined for mark retention using ultraviolet light in a darkened room.

Shrimp used in this study ranged in average size from 50 to 80 mm total length and were obtained from the Galveston Bay area.

TABLE 1

Percent retention of fluorescent spray-mark in juvenile penaeid shrimp averaging 80 mm total length in relation to time and spray pressure

Number of days after spray-marking	Spray pressure (in pounds per square inch)						
	80	100	120	150	180	220	240
	Percent						
4	0	0	0	88.8	87.8	77.0	100
8	—	—	—	83.3	85.4	60.7	100
12	—	—	—	83.3	60.0	59.2	100
16	—	—	—	83.3	57.7	57.6	100
20	—	—	—	80.5	56.8	50.0	100
70	—	—	—	—	—	—	100
Number marked	50	51	55	48	79	75	63

— = No observation made.

RESULTS

Pigment granules in spray-marked shrimp (visible as spots of orange fluorescence under ultraviolet light) were primarily located in or under the exoskeleton of the abdominal segments and in the paired appendages (Fig. 1). The tougher exoskeleton of the carapace usually was not penetrated by pigment granules and typically showed no fluorescence.

Spray pressures of 80, 100, and 120 psi were found to be too low for marking juvenile shrimp. None of the shrimp spray-marked at these pressures retained pigment longer than 4 days. Satisfactory retention of the mark for the 20-day period of the experiment was obtained using air pressures of 150 to 240 psi. Retention in 80-mm shrimp spray-marked at 180 and 220 psi was lower (Table 1) than those marked at 150 psi and 240 psi.

Water temperature differences during these experiments may account for these apparent discrepancies. The average water temperature during the 150 psi marking experiment was 15°C, while that for experiments run at 180, 220,

¹ Trade names referred to in this publication do not imply endorsement of commercial products.



FIG. 1. Photograph (using ultraviolet light) of spray-marked juvenile brown shrimp (*Penaeus aztecus*) 4 days after being marked. Fluorescent pigment granules visible as bright spots are located primarily in the abdominal region and on the appendages.

and 240 psi averaged about 22°C. The lower temperature in the 150 psi experiment may have masked the effect of molting on mark retention. Molting may have been a factor at the higher temperature in the experiments run at 180 and 220 psi. However, 97% of the 80-mm shrimp spray-marked at 240 psi and held at 21°C molted during the 20-day experiment, yet none lost the mark during this

period. Fluorescent pigment granules apparently lodged in tissues beneath the exoskeleton in these shrimp, decreasing or eliminating the probable effect of molting on mark retention. Some of these shrimp were held for an additional 50 days. All 11 shrimp (80 mm) surviving 70 days after spray-marking at 240 psi had retained the mark.

Retention of the spray-mark in shrimp increased with increased average length of shrimp (Fig. 2). One-hundred percent of juvenile shrimp averaging 80 mm in

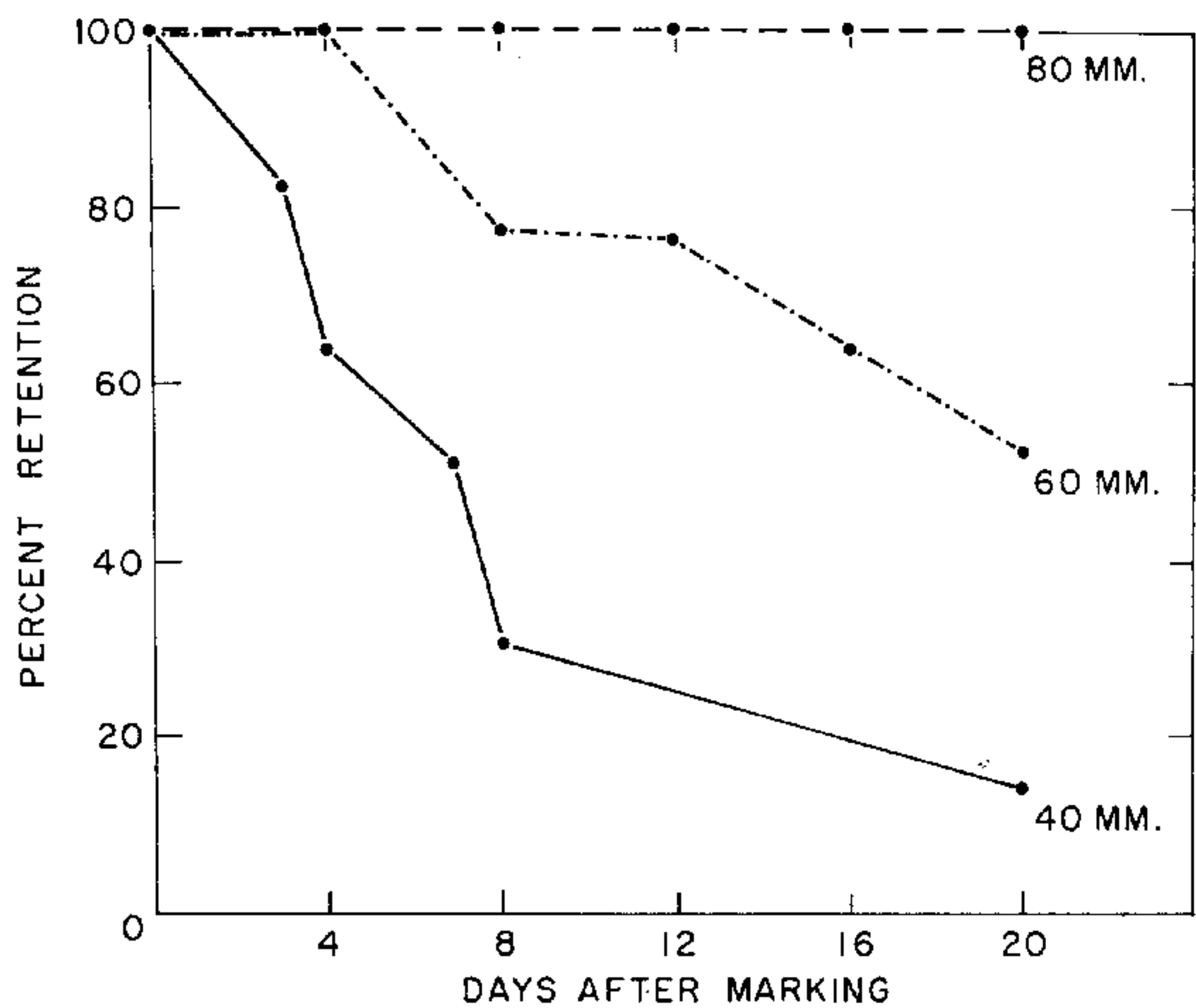


FIG. 2. Percent retention of mark in juvenile penaeid shrimp of three size groups spray-marked with granular fluorescent pigment at a pressure of 240 psi.

TABLE 2

Percent retention of fluorescent spray-mark in juvenile penaeid shrimp in relation to size and time after spray-marking at 240 psi

Number of days after spray-marking	Average length (in millimeters)		
	40	60	80
	Percent		
3	82.5	—	—
4	64.3	100	100
7	51.1	—	—
8	30.6	77.5	100
12	—	76.3	100
16	—	64.2	100
20	14.8	52.2	100
70	—	—	100
Number marked	125	222	63

— = No observation made.

total length retained pigment 20 days after being spray-marked at 240 psi, while shrimp averaging 60 mm and 40 mm in total length had only 52.2% and 14.8% mark retention after 20 days, respectively, when spray-marked at the same pressure (Table 2).

Mortality resulting directly from spray-marking was negligible (always less than 5%) in the experiments reported here, with only an occasional mortality occurring within the first 24 hours after spray-marking. Holding mortalities in control and marked groups were high, however, and necessitated termination of formal experiments after 20 days. These mortalities were primarily due to cannibalism.

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